BARRIER RIB MATERIAL FOR PLASMA DISPLAY PANEL

Background of the Invention:

The present invention broadly relates to a barrier rib material for use in a plasma display panel.

A plasma display panel is generally a self-luminous flat display, and have various useful characteristics such as lightweight, a thin thickness and a wide viewing angle, thereby readily achieving a larger display area. Therefore, a great attention has been paid for such a plasma display as one of the most-promising display devices.

Referring now to a sole figure, description will be hereinafter made about an existing plasma display panel as a related art.

The plasma display panel generally comprises a front glass substrate 1 and a rear glass substrate 2 facing each other, and barrier ribs 3 formed within the space between the substrates 1 and 2.

With this structure, the barrier ribs 3 are formed so as to divide a space between the substrates 1 and 2 into a plurality of gas discharge portions. A pair of transparent electrodes 4 are formed on the interior surface of the front glass substrate 1, and a voltage is applied between the transparent electrodes 4 to thereby induce plasma discharge.

A dielectric layer 5 is formed on the transparent electrodes 4 so as to fully cover the front glass substrate 1. A protective layer 6 made of MgO is formed on the dielectric layer 5 so as to stabilize the plasma formation.

A data electrode (an address electrode) 7 is formed on the rear glass substrate 2 between two barrier ribs 3, and a phosphor 8 is applied onto side

walls of the barrier ribs 3 and onto the rear glass substrate 2 between the barrier ribs 3 so as to cover the data electrode 7.

Specifically, a voltage is applied between the transparent electrodes 4, and plasma discharge occurs in the gas discharge portion divided by the barrier ribs 3. An ultraviolet ray generated by the plasma discharge is irradiated to the phosphor 8, so that the phosphor 8 emits a visible light ray.

In the aforementioned plasma display panel, the barrier ribs 3 are generally formed on the rear glass substrate 2. The rear glass substrate 2 with the barrier ribs 3 is arranged so as to face the front glass substrate 1 to thereby constitute a panel.

In the panel structure shown in the figure, the barrier ribs 3 are formed directly on the rear glass substrate 2. Alternatively, a protective dielectric layer is formed on the rear glass substrate 2 so as to cover and protect the data electrode 7, and then, the barrier ribs 3 are formed on the dielectric layer in some panel structures.

The barrier ribs 3 are generally formed by a printing lamination process or sandblast process. In the printing lamination process, printing is repeatedly carried out for a barrier rib forming portion by screen-printing with a plurality of times, and the barrier rib is formed via lamination due to lap applying.

In the sandblast process, the barrier ribs 3 are formed in the following manner. Initially, a layer of the barrier rib material is formed to a predetermined thickness directly on the rear glass substrate or with the interposition of a dielectric layer so as to fully cover the underlayer. The barrier rib material layer is formed by screen-printing a paste of the barrier rib material to the underlayer and drying the printed paste, or by laminating a green sheet onto the underlayer. Subsequently, a photoresist is applied onto the layer of the barrier rib material to form a resist film, the resist film is subjected to exposure to light irradiation and

development, and portions where the resist film is not formed are removed by sandblasting to thereby form the barrier ribs at predetermined portions.

In general, such barrier rib materials must be cured at temperatures of 600°C or lower to prevent deformation of a glass substrate, must have a thermal expansion coefficient of from 60 x 10^{-7}/°C to 85 x 10^{-7}/°C (at temperatures ranging from 30°C to 300°C), as much as those of the glass substrates so as to prevent a crack or peeling of the barrier ribs, and must be resistant to an alkali solution used in the formation of the barrier ribs. In this event, the barrier rib material generally includes a glass powder and a filler powder.

Glass having a low melting temperature is used as the glass powder, of which PbO glasses is widely used generally.

On the other hand, an alumina powder is widely used as the filler powder in order to maintain the configurations of the barrier ribs and to attain sufficient strength.

In the plasma display panel, the phosphor is irradiated with ultraviolet rays to thereby emit visible light as mentioned above, thus increasing power consumption.

Accordingly, the plasma display panel must be reduced in power consumption. For this purpose, a reduction in the dielectric constant of the barrier rib material is believed to be effective.

In order to reduce the dielectric constant of the barrier ribs, Japanese Unexamined Patent Publication (A) No. H 11-162361 proposes a barrier rib material containing two or more types of quartz glass, α-quartz and cristobalite, as fillers. However, when this barrier rib material is used, the resulting barrier rib is not mechanically strong enough.